

AD-A167 745

NAVAL WEAPONS STATION CHARLESTON FLEET MOORINGS
UNDERWATER INSPECTION PLAN(U) NAVAL FACILITIES
ENGINEERING COMMAND WASHINGTON DC CHESAPEAKE DIV

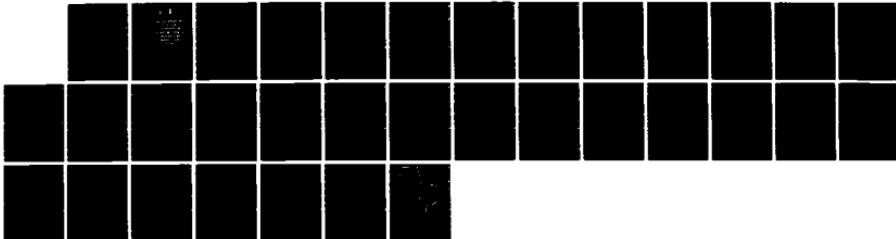
1/1

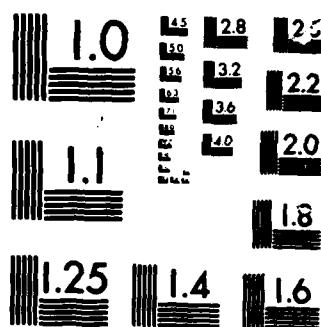
UNCLASSIFIED

31 MAR 83 CHES/NAVFAC-FPO-8317.5

F/G 13/2

NL





MICROCOM[®]

CHART

FPO
8317.5



AD-A167 745

DTIC
SELECTED
MAY 02 1986
S D
D

NAVAL WEAPONS STATION CHARLESTON FLEET MOORINGS UNDERWATER INSPECTION PLAN

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited

31 MARCH 1983

OCEAN ENGINEERING
AND CONSTRUCTION PROJECT OFFICE
CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON, D.C. 20374

DTIC FILE COPY

86 422 020

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION

1b. RESTRICTIVE MARKINGS

Unclassified

2a. SECURITY CLASSIFICATION AUTHORITY

3. DISTRIBUTION AVAILABILITY OF REP.

Approved for public release;
distribution is unlimited

2b. DECLASSIFICATION/DOWNGRADING SCHEDULE

4. PERFORMING ORGANIZATION REPORT NUMBER

FPO 8317.5

5. MONITORING ORGANIZATION REPORT #

6a. NAME OF PERFORM. ORG. 6b. OFFICE SYM
Ocean Engineering
& Construction
Project Office
CHESNAVFACENGCOM

7a. NAME OF MONITORING ORGANIZATION

6c. ADDRESS (City, State, and Zip Code)
BLDG. 212, Washington Navy Yard
Washington, D.C. 20374-2121

7b. ADDRESS (City, State, and Zip)

8a. NAME OF FUNDING ORG. 8b. OFFICE SYM

9. PROCUREMENT INSTRUMENT IDENT

8c. ADDRESS (City, State & Zip)

10. SOURCE OF FUNDING NUMBERS

PROGRAM	PROJECT	TASK	WORK UNI
ELEMENT #	#	#	ACCESS

11. TITLE (Including Security Classification)

Naval Weapons Station Charleston Fleet Moorings Underwater Inspection Plan

12. PERSONAL AUTHOR(S)

13a. TYPE OF REPORT 13b. TIME COVERED 14. DATE OF REP. (YYMMDD) 15. PAGE
FROM TO 83-03-31 32

16. SUPPLEMENTARY NOTATION

17. COSATI CODES 18. SUBJECT TERMS (Continue on reverse if nec.
FIELD GROUP SUB-GROUP Fleet moorings, Mooring inspections.
Underwater inspections, NWS Charleston.
Charleston, SC

19. ABSTRACT (Continue on reverse if necessary & identify by block number)
As part of COMNAVFACENGCOM's Fleet Mooring Maintenance (FMM) Program, CHESNAV-
FACENGCOM has been assigned the responsibility for the conduct of underwater
inspections of fleet moorings worldwide. This plan provides guidelines for
the underwater inspection of the three fleet moorings operated and (Con't)

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT 21. ABSTRACT SECURITY CLASSIFICATION
SAME AS RPT.

22a. NAME OF RESPONSIBLE INDIVIDUAL 22b. TELEPHONE 22c. OFFICE SYMBOL
Jacqueline B. Riley 202-433-3881

DD FORM 1473, 84MAR SECURITY CLASSIFICATION OF THIS PAGE

BLOCK 19 (Con't)

maintained by the Naval Weapons Station Charleston, South Carolina. This inspection is scheduled to occur in early April 1983.

CHESNAVFACENGCOM has designated an Engineer-in-Charge (EIC) to provide on site technical guidance to the Underwater Construction Team One (UCT-ONE) divers who will actually perform the underwater portion of the inspection. In addition, the EIC will prepare the post-inspection report which will include the results of the inspection and recommendations for required maintenance actions.

FLEET MOORING INSPECTION PLAN

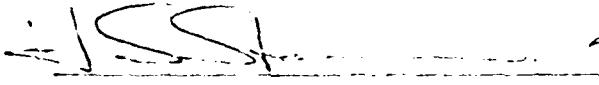
CHARLESTON NAVAL WEAPONS STATION

APRIL 1983

OCEAN ENGINEERING AND CONSTRUCTION
PROJECT OFFICE

CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON D. C. 20374

APPROVED:


4-7-83
H. S. STEVENSON, CDR, CEC, USN
Head, Ocean Engineering and
Construction Project Office
CHESNAVFACENGC

F. DiGEORGE, LCDR, CEC, USN
Officer in Charge
UCT ONE

TABLE OF CONTENTS

Paragraph	Page
1.0 BACKGROUND	1
2.0 GENERAL MOORING HISTORY	1
3.0 INSPECTION PROCEDURES	5
3.1 Inspection Objectives	5
3.2 Buoy	10
3.2.1 Buoy Upper Portion	10
3.2.2 Buoy Lower Portion	10
3.2.3 Bottom Jewelry	11
3.3 Riser	11
3.4 Ground Ring	11
3.5 Ground Legs	11
3.6 Anchors	11
3.7 Photography	14
3.7.1 Topsides	14
3.7.2 Underwater	14
3.8 Cathodic Protection	14
4.0 DOCUMENTATION	14
5.0 MEETINGS/BRIEFINGS	15
6.0 LOGISTICS	15
6.1 UCT ONE	15
6.2 CHESNAVFACEENGCOM	16
ANNEX	
A MEASURING DEVICES AND THEIR USE	A-1
B SAMPLE INSPECTION FORMS	B-1
C RESULTS OF 1979 ARDM INSPECTION	C-1



Accession For	
NTIS CRA&I <input checked="" type="checkbox"/> DTIC TAB <input type="checkbox"/> Unannounced <input type="checkbox"/> Justification _____	
By _____	
Distribution / _____	
Availability Codes	
Dist	Avail and/or Special
A-1	

NWS CHARLESTON UNDERWATER INSPECTION PLAN

1.0 BACKGROUND

As part of COMNAVFACENGCOM's Fleet Mooring Maintenance (FMM) Program, CHESNAVFACENGCOM has been assigned the responsibility for the conduct of underwater inspections of fleet moorings worldwide. This plan provides guidelines for the underwater inspection of the three fleet moorings operated and maintained by the Naval Weapons Station Charleston, South Carolina. This inspection is *was* scheduled to occur in early April 1983.

CHESNAVFACENGCOM has designated an Engineer-in-Charge (EIC) to provide on site technical guidance to the Underwater Construction Team One (UCT-ONE) divers who will actually perform the underwater portion of the inspection. In addition, the EIC will prepare the post-inspection report which will include the results of the inspection and recommendations for required maintenance actions.

2.0 GENERAL MOORING HISTORY

NAVWEPPSTA Charleston currently operates and maintains three fleet moorings . . . a Mediterranean type mooring, an ARDM, and an auxiliary mooring. Each of these moorings is installed in the Cooper River within a half a mile of Pier C at the Weapons Station. The locations of these moorings are shown in Figure 1. A brief description of each of these moorings follows:

- Mediterranean Mooring — The Mediterranean mooring consists of two stakepile moorings which are used to moor the bow of a tender. The stern of the tender is moored to a pier. Stakepile moorings are positioned to the port and starboard of the tender's bow. Each stakepile mooring consists of 3 1/2" chain and 2 — 12,600 pound cast iron sinkers, attached to a 300,000 pound stakepile with the required connecting links. Figure 2 is a schematic drawing of this mooring.
- ARDM Mooring — The Auxiliary Recovery Drydock Medium (ARDM) mooring is used to anchor a floating drydock. Each of the thirteen legs consists of 2 3/4" chain with necessary connecting links attached to a 25,000 pound anchor with stabilizers. Cathodic protection has been installed on the ARDM and consists of an impressed current system involving 2 — 300 amp capacity, standard calomel reference controlled constant potential systems. The systems are set to provide a constant potential of approximately -0.85 volts. Figure 3 is a schematic

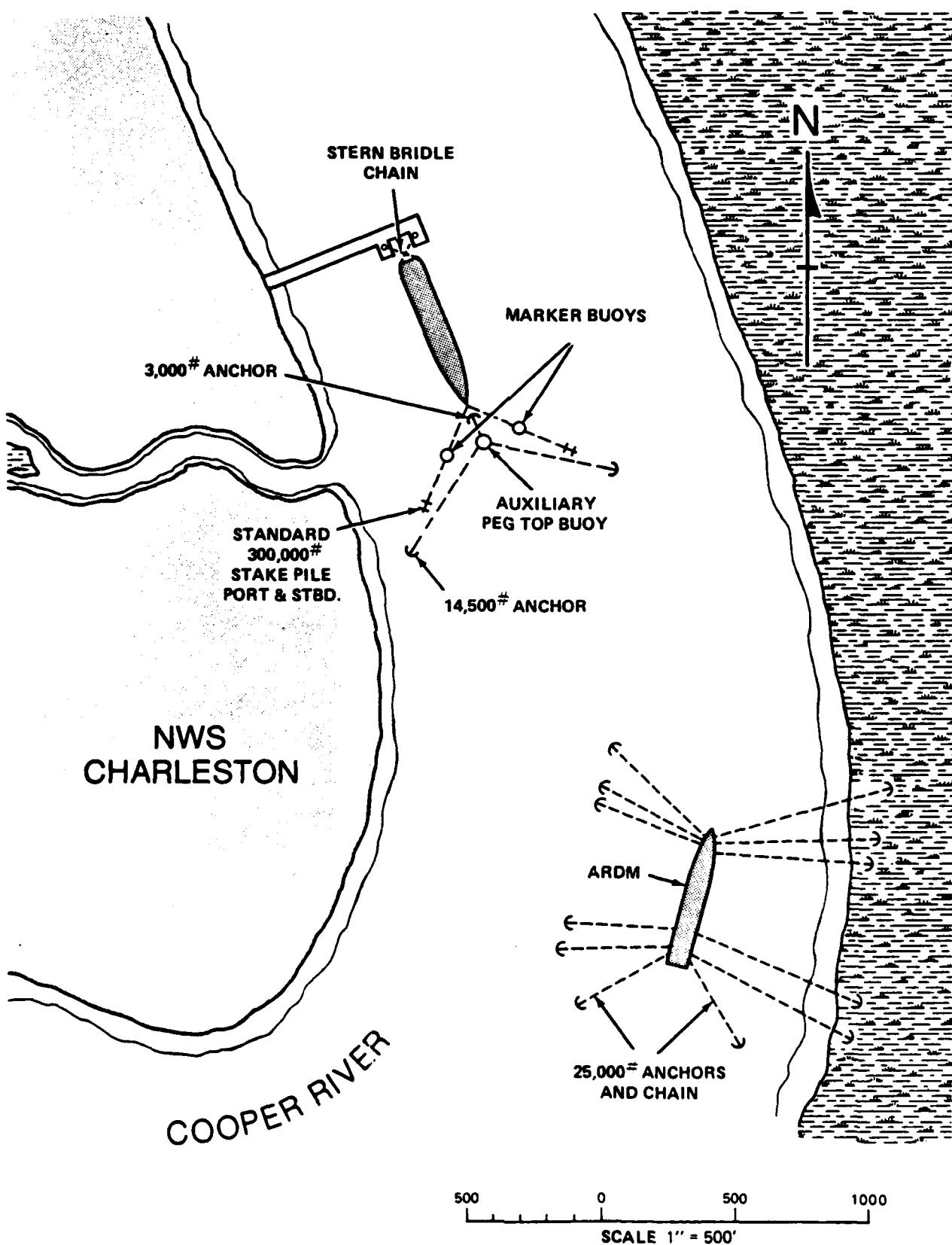


Figure 1. Mooring Locations

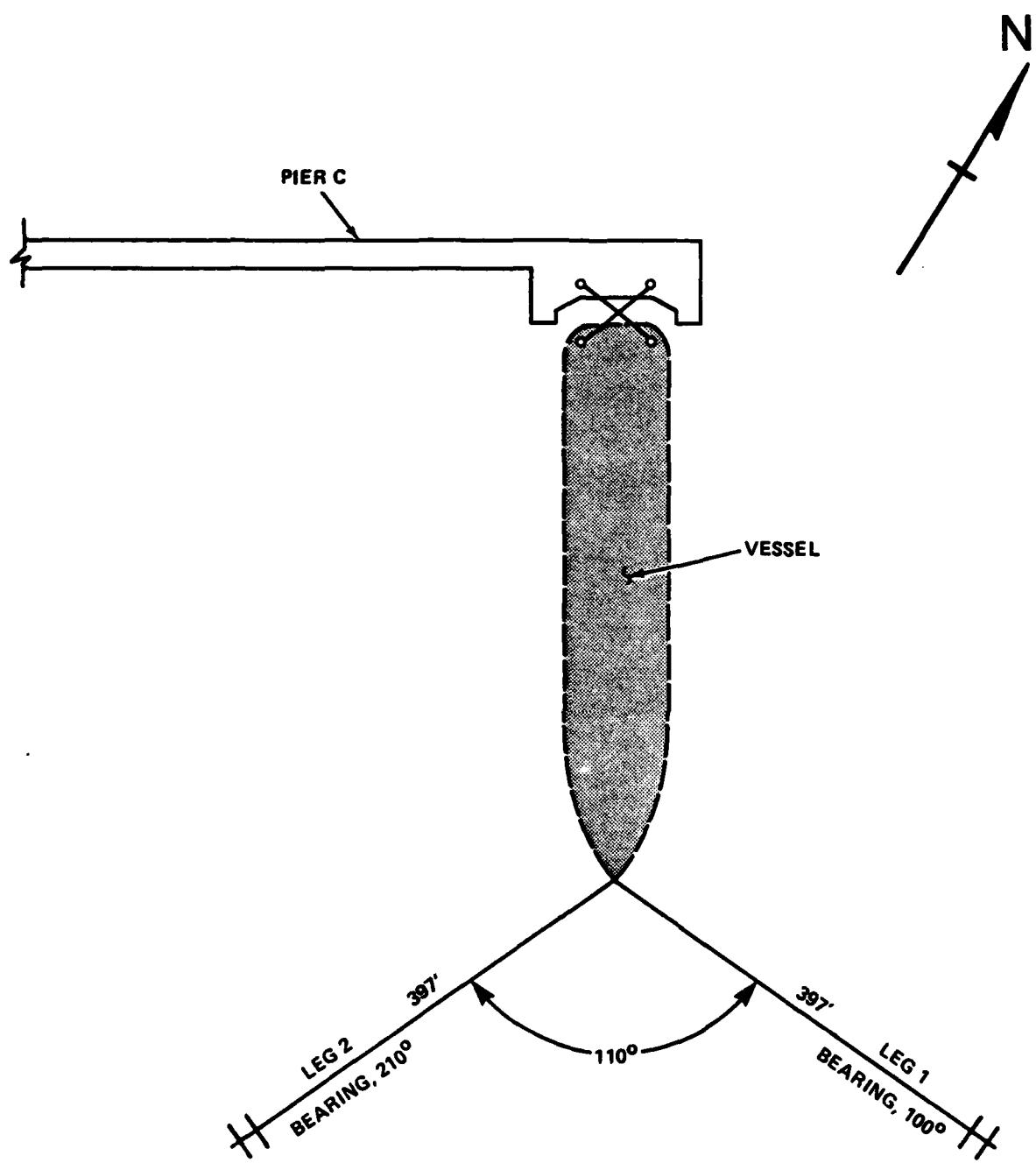


Figure 2. Schematic Drawing of NWS Charleston's Mediterranean Mooring

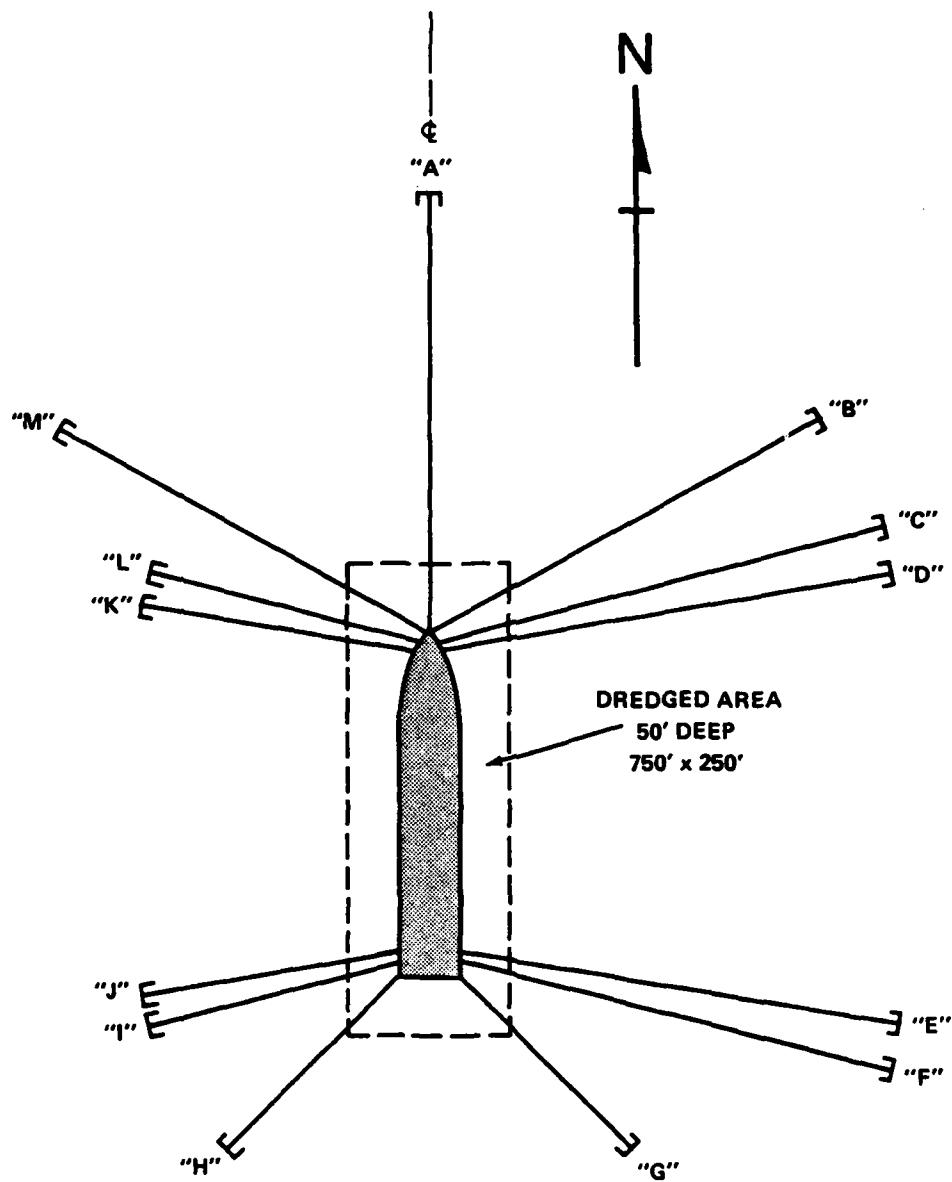


Figure 3. Schematic of Spread Mooring for ARDM-2 (USS ALAMOGORDO)

drawing of the ARDM mooring. Figures 4 and 5 depict the composition of the ARDM mooring legs while Tables 1 through 3 contain the material lists of each type of leg.

- **Auxiliary Mooring** – The auxiliary mooring is a riser type mooring located directly off the bow of the tender and between the two stakepiles of the Mediterranean mooring. The mooring consists of a Peg Top buoy, a 2 1/4 inch riser, a ground ring, and three ground legs attached to anchors. Two of these legs are comprised of 2 1/4 inch chain and 14,500 pound anchors while the third, a backstay leg, consists of a 1 1/2 inch chain and a 3,000 pound anchor. Figure 6 shows the composition of the auxiliary mooring.

Under CHESNAVFACEENGCOM direction, UCT ONE divers conducted an underwater inspection of the ARDM mooring in January 1979. In addition, during November of 1981, a consulting engineering firm was contracted to conduct underwater inspections of all three moorings. A summary of the results of the latter, most recent inspection appear in Annex C.

3.0 INSPECTION PROCEDURES

3.1 **Inspection Objectives.** The purpose of mooring inspections is to determine the general physical condition of buoys and chain assemblies and, when possible, to verify or update existing as-built and maintenance records. Underwater inspections performed by divers inspect only a portion of the submerged buoy hull and chain assemblies in order to compile a general description of the mooring's condition. The existence of fairly consistent measurements during this inspection provides a good indication of the mooring's overall condition. It should be kept in mind that periodic underwater inspections are intended as an expedient and relatively inexpensive supplement to accurate maintenance records. As such, they cannot fully substitute for a complete inspection involving recovery of the mooring and the measurement and evaluation of each component.

One of the more important parameters used to evaluate the condition of a mooring is chain wire diameter. After cleaning to bare metal, a selective sampling of the wire diameter of chain links and connecting hardware is taken in order to determine the amount of deterioration due to corrosion and wear. "Single Link" measurements are taken where chain is slack, and detect only corrosion loss. "Double Link" measurements, taken where two links connect under tension, detect the combined effects of corrosion and wear. Chain links and other components which measure 90% or greater of original wire diameter are considered to be in "good" condition; measurement between 80% and 90% of original diameter is considered "fair" condition and is cause for the mooring to be downgraded in classification; any measurement

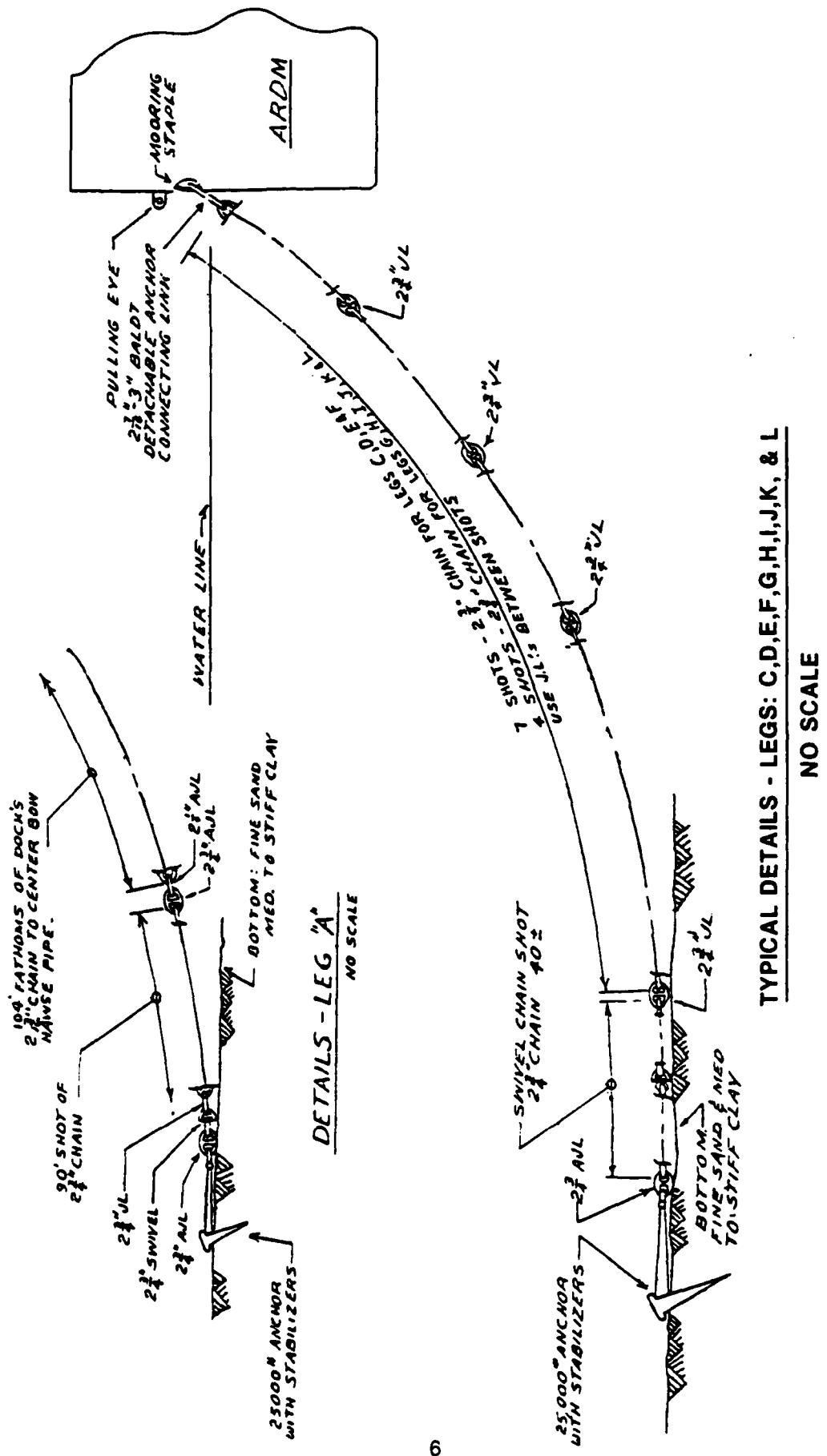


FIGURE 4. ARDM LEG A,C,D,E,F,G,H,I,J,K, & L

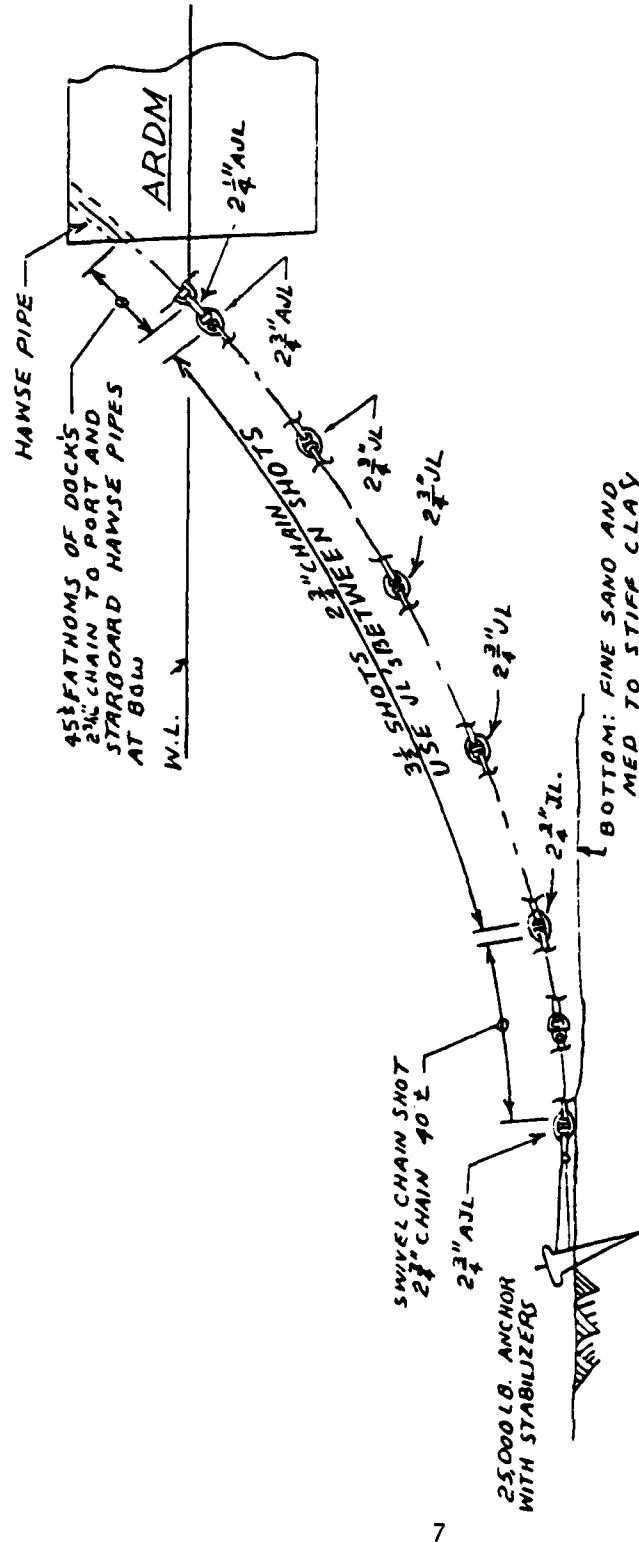


FIGURE 5. ARDM LEGS B & M

TABLE 1. BILL OF MATERIAL FOR LEG "A" ONLY

DESCRIPTION OF ITEM	REQ'D
25,000" Standard Navy Stockless Anchor With Stabilizers	1
2 3/4" Anchor Joining Link	2
2 1/4" Anchor Joining Link	1
2 3/4" Joining Link	1
2 3/4" Swivel	1
2 3/4" Chain - 90' Shot	1

**TABLE 2. BILL OF MAT'L FOR LEGS C, D, E, F, G, H, I, J, K, L,
MATERIAL FOR EACH LEG**

DESCRIPTION OF ITEM	REQ'D
25,000" Standard Navy Stockless Anchor With Stabilizers	1
2 3/4" Anchor Joining Link	1
2 3/4" Joining Link	4
2 3/4" Chain - 90' Shot	4
2 3/4" Chain - 40' = Swivel Shot	1
2 1/16" - 3" Balot Detachable Conn. Lk.	1

TABLE 3. BILL OF MATERIAL FOR LEG "B" & "M" MATERIAL FOR EACH LEG

DESCRIPTION OF ITEM	REQ'D
25,000" Standard Navy Stockless Anchor With Stabilizers	1
2 3/4" Anchor Joining Link	2
2 3/4" Chain - 4'± Swivel Shot	1
2 3/4" Chain - 90' Shot	3
2 3/4" Chain - 45' Shot	1
2 3/4" Joining Link	4
2 1/4" Anchor Joining Link	1

THE AUXILIARY MOORING WAS DESIGNED FOR 35 MPH WIND AND 8.5 KNOTS OF CURRENT.

BILL OF MATERIAL	
DESCRIPTION OF ITEM	REQ'D
HAMMER FAIRLEAD	1
PEG TOP BUOY	1
2 1/4" ANCHOR JOINING LINK	7
2 1/4" JOINING LINK	12
2 1/4" SIVEL	3
2 1/4" GROUND RING	1
1 1/2" ANCHOR JOINING LINK	2
14,500 LB. ANCHOR	2
3,000 LB. ANCHOR	1
2 1/4" CHAIN (90' SHOT)	8
1 1/2" CHAIN (90' SHOT)	1
1 1/2" JOINING LINK	1
1 1/2" SIVEL	1
2 1/4" CHAIN (45' SHOT)	2
2 1/4" CHAIN (37 LINKS)	1
2 1/2" JOINING LINK	2

9

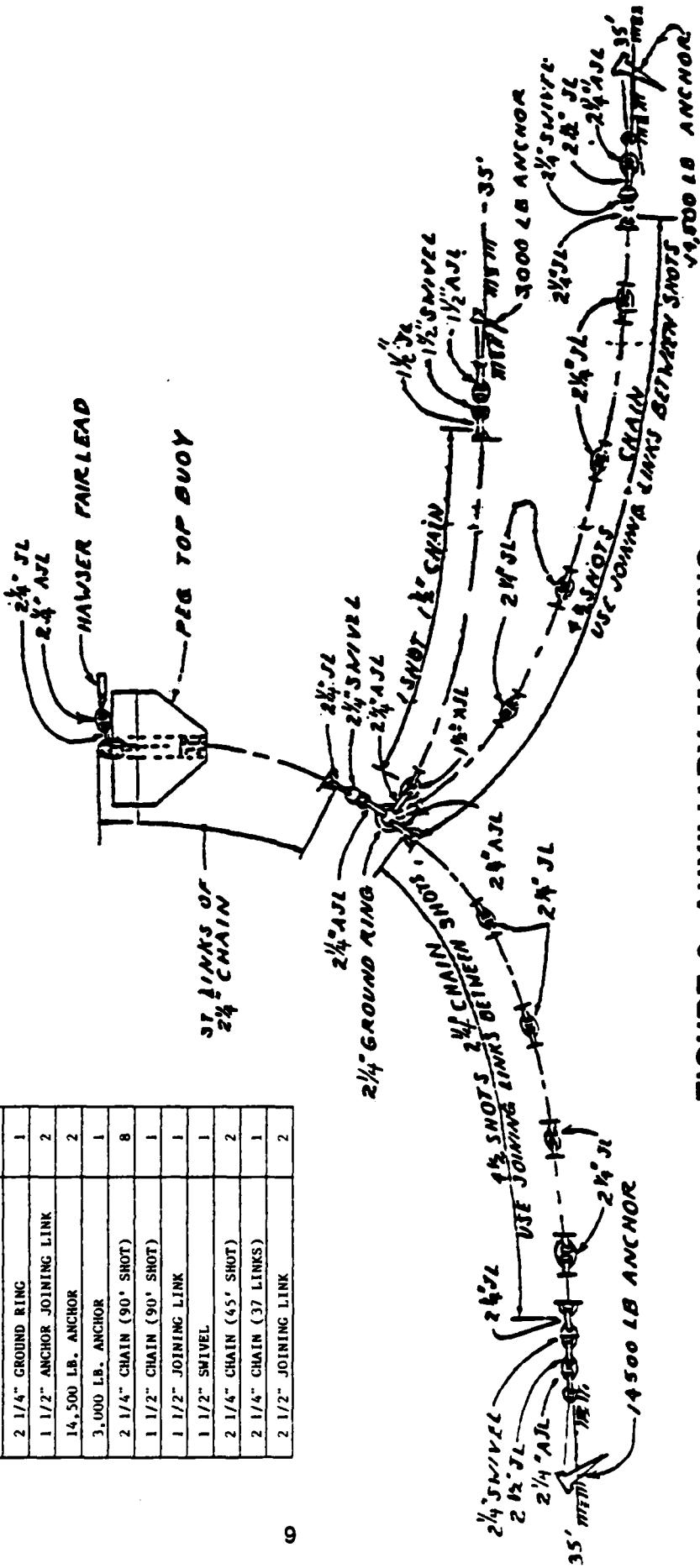


FIGURE 6. AUXILIARY MOORING

less than 80% is considered "poor" and is cause for the mooring to be declared unsatisfactory for fleet use. Figure A-1 in Annex A depicts the proper method of taking both single and double link measurements.

Standard underwater inspection procedures do not call for the inspection of any part of the mooring which is buried. Ground legs and risers are observed only to the point at which they become buried; no attempt is made to locate and inspect anchors or other mooring materials which are not readily visible.

The following paragraphs contain the general inspection procedures that will be followed.

3.2 Buoy. The geographic position of each buoy should be verified. In order to accomplish this, each buoy is to be accurately sighted from known positions ashore.

3.2.1 Buoy Upper Portion. The buoy shall be observed to determine its general condition. The size of the buoy (diameter and height) should be recorded along with its freeboard. Physical damage such as holes, dents, or listing shall be described. If the buoy is fiberglass coated, then the fiberglass should be inspected for cracks, wear, peeling, or rust-bleeding. A check will be made to see if the hatches have been fiberglassed over. If the buoy has not been fiberglassed, then the paint will be checked for cracking, chipping, and peeling. Hatches, openings, and penetrations will be examined and broken parts and rust will be reported.

The buoy fenders and rubbing rails shall be checked for integrity and secure connection to the buoy.

Buoy top jewelry shall be identified and measured with calipers to find the overall outside dimensions and areas of most severe reduction in wire size. Methods for presetting calipers are contained in Annex A.

3.2.2 Buoy Lower Portion. Divers shall thoroughly inspect the buoy below the waterline. The thickness of marine growth shall be recorded, three one-foot-square areas shall be selected and cleared of growth without damaging the paint or fiberglass, and the condition of the paint or fiberglass will be noted. If the buoy is a riser-type with a hawse pipe, the presence and condition of the rubbing casting shall be recorded. If the buoy is cathodically protected, the condition, dimensions, and connection of anodes are to be noted. Then, electrical potential readings are to be taken with an underwater voltmeter at three locations on the buoy bottom.

3.2.3 Bottom Jewelry. On each mooring, the jewelry connecting the buoy to the riser shall be identified and measured with calipers. As with the topside jewelry, the overall dimensions and the smallest wire size of each type of link or shackle will be recorded.

3.3 Riser. Three consecutive double link measurements using pre-cut gauges will be made at both ends and near the center of the riser. Procedures for the use of pre-cut gauges are also contained in Annex A. The swivel and detachable links contained within the riser assembly shall be visually inspected and measured.

3.4 Ground Ring. The ground ring shall be examined for general and localized wear. Caliper measurements shall be made of the wire size in the region of the most severe wear and across the inner diameter.

3.5 Ground Legs. Double link measurements of each shot of chain in each ground leg shall be taken in the same manner as the riser. In those cases where the ground leg chain is slack and not in tension, three single link measurements shall be taken of each selected link as shown in Figure A-2 (Annex A). All connecting hardware including detachable links, anchor joining links, pear links, end links, swivels and shackles shall be identified and measured with calipers. Worn hardware and unusual chain joining practices shall be recorded and photographed.

The legs shall be labeled A, B, and C clockwise from magnetic north and their orientation (determined by diver's compass) sketched as in Figure 7.

In addition, the divers will survey each ground leg of the Mediterranean and auxiliary moorings using an inclinometer and a depth gauge in order to establish ground leg catenary profiles. The catenary angle will be measured at each 10 feet of depth, as shown in Figure 8, between the ground ring and the mud line. A pop float will be attached to the ground leg chain where it meets the bottom (and the water depth recorded) so that topside personnel can measure the horizontal distance between the buoy and the point at which the ground leg reaches the bottom. The EIC will also determine the height of the tide at the time these measurements are being taken and the wind speed and direction. This data will determine the catenary profile of each ground leg. In a similar manner, the catenary profile of each of the 13 ARDM legs will be determined. Figure 9 shows how the catenary angles of each leg will be measured.

3.6 Anchors. If an anchor is located, a pop float shall be attached to it so that the relative positions of the anchor from the mooring buoy can be observed from the surface. The anchor's position shall be recorded. The hardware connecting an anchor to its ground leg will be measured by calipers and the wire diameters recorded.

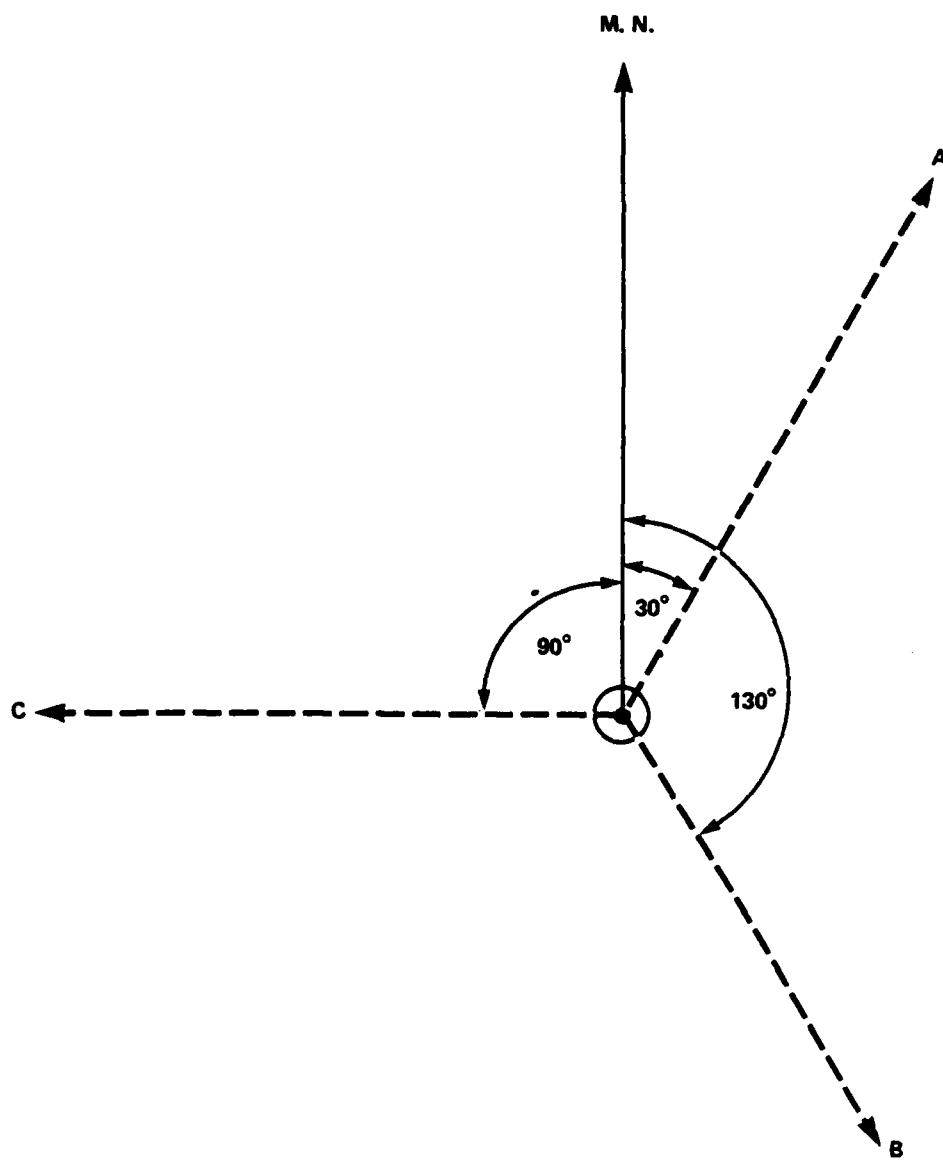


Figure 7. Magnetic Bearing of Ground Legs

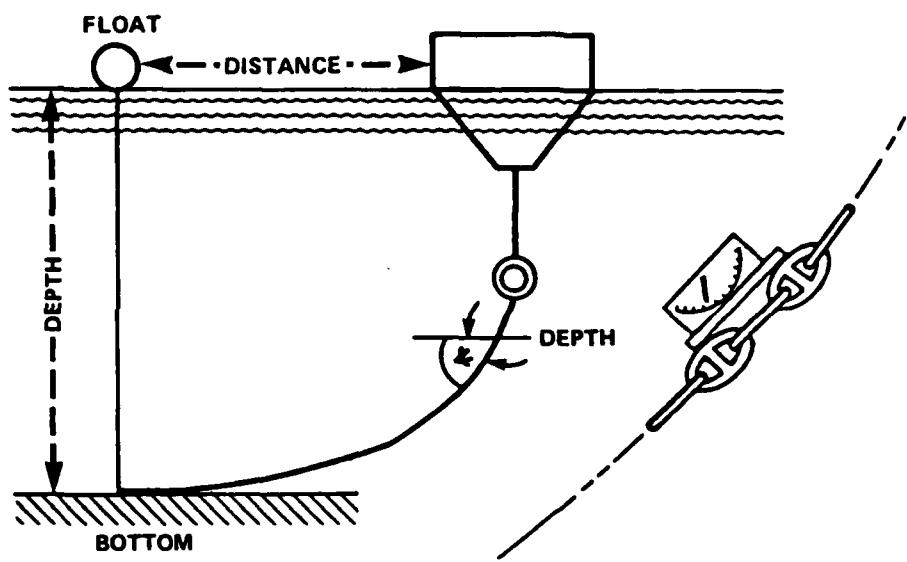


Figure 8. Determining Catenary Profiles

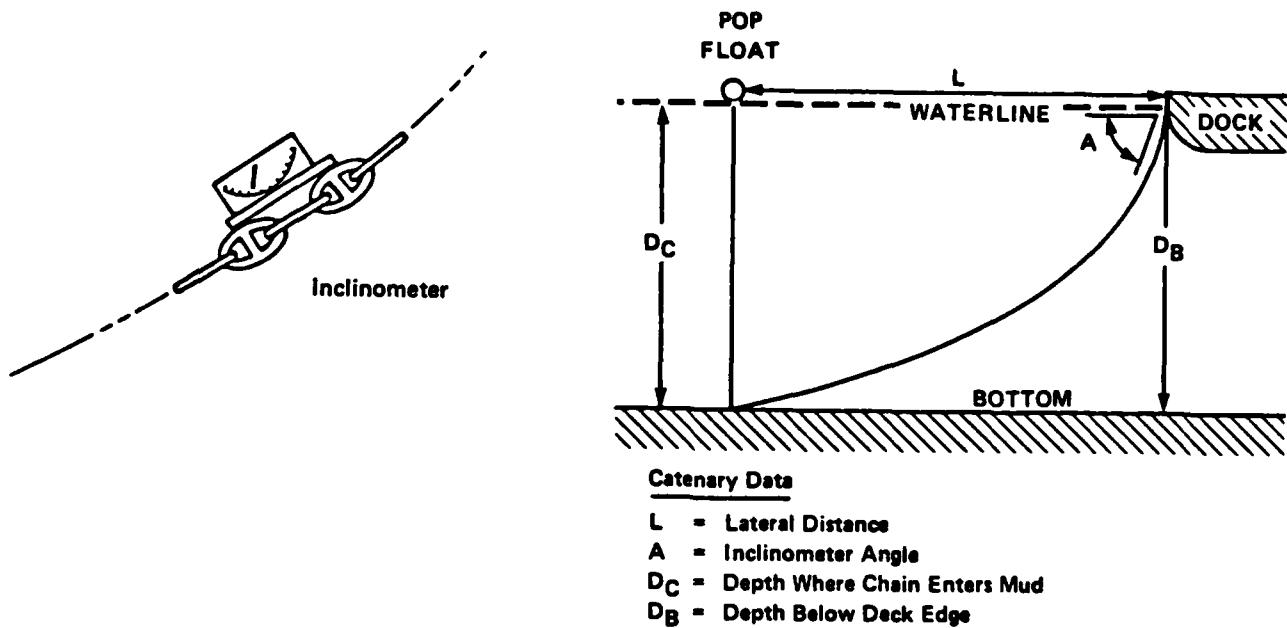


Figure 9. Determining Catenary Profiles

3.7 Photography

3.7.1 Topside. Topside photography and ashore photographs are the responsibility of the Engineer-in-Charge.

Photographs will be taken of each buoy showing its general condition. Photographs of the topside jewelry and damaged buoy components will be taken as deemed appropriate by the EIC.

Photographs will be taken of ashore spare mooring material inventories and construction equipment as deemed necessary.

3.7.2 Underwater. Underwater photography shall be the responsibility of the dive team. Buoy bottoms, bottom jewelry, worn links, swivels, ground rings, and other hardware shall be photographed wherever required to support material conditions and when environmentally feasible. Photographs shall include clear annotation as to the location of the hardware being photographed.

3.8 Cathodic Protection. Any moorings found to have cathodic protection should be inspected using the following procedures.

The underwater voltmeter (after on-site calibration by the dive team) will be used to probe the chain every 20 feet commencing with the buoy and bottom jewelry and continuing until the anchor is reached or the chain disappears into the bottom. All potential measurements to be provided in the "Comments" column of Table B-1. Before cleaning, divers will photograph each anode and record the thickness, type and accumulation of the coating. Several anodes should be brushed to remove the oxidation and the length, width and depth of the remaining zinc measured and photographed. Anodes in poor condition should be measured, reported and photographed.

4.0 DOCUMENTATION

The Engineer-in-Charge will document the inspection procedures used and record the data obtained by the dive team. He may recommend additional alternative inspection requirements as deemed necessary during the course of the inspection. He will maintain a time log of events occurring during the inspection, and the master inspection form. In addition, the EIC must be prepared to debrief each diver, upon his return to the surface, in order to gain immediate knowledge of what the diver observed. The information obtained from the divers will be recorded, and this data will subsequently be the basis for the

development of the moorings as-built configuration and for the preparation of the Fleet Mooring Inspection Report, which will contain the results of the inspection and recommendations for corrective maintenance actions.

While on site, the EIC will investigate the availability and cost of local mooring maintenance support. In addition, he will conduct a cursory inspection of any on-shore Fleet Mooring Inventory (FMI) used for maintenance and repair or ready reserve. The type, size, quantity and general condition of the inventory shall be reported.

5.0 MEETINGS/BRIEFINGS

Upon arrival on site, the Engineer-in-Charge will conduct a pre-dive briefing to familiarize diving personnel with the mooring inspection procedures and to advise them of possible modifications to this inspection plan. In addition, the EIC will give a post-inspection debriefing to advise station personnel of the preliminary inspection findings.

6.0 LOGISTICS

6.1 UCT ONE. The following equipment will be provided by the divers in support of this inspection:

- All diving support equipment
- Measuring aids
 - 100' tape measures
 - Scales 1, 2, and 3 feet with large numbers suitable for photo documentation
 - Accurate depth gauges
 - Marker tags to relocate or mark chain links or accessories
- Survey equipment
 - Compass (diver's)
 - Survey buoys with line (pop floats)
- Two Underwater still cameras (35mm) with film (color and B & W) flash with spare batteries

- Calipers
- Go/no-go guages
- Cleaning equipment – Hand tools including wire brushes, chipping hammers, and sharp chisels.
Water blaster with water or hydraulic power supply and brush tool.
- Surveying transits for establishing location of mooring buoys

8.2 CHESNAVFACENGCOM. The CHESNAVFACENGCOM Engineer-in-Charge will provide the following:

- Inspection plan
- Data sheets and forms
- 35mm surface camera and film
- Drafting supplies, graph paper, scales
- Calculator
- Pre-dive briefing data
- DM-26

ANNEX A

MEASURING DEVICES AND THEIR USE

ANNEX A

1.0 MEASURING DEVICES AND THEIR USE

Tables A-1 and A-2 outline the 80 and 90 percent measurements for mooring components. These tables are based on the standard sizes of mooring material listed in DM-26 and can be used to preset calipers before measuring various items. For example, a class BB riser type mooring will require calipers set to 3.15" (90%) and 2.80" (80%) for single link measurements on the riser; 6.30" (90%) and 5.60" (80%) for double link on the riser; 2.25" and 2.0" for single link on the ground legs; 4.50" and 4.00" for double link on the ground legs; and for the ground ring 5.85" and 5.20".

The preferred measuring devices, however, are back-to-back 80 and 90 percent "go-no go" gauges. These gauges simplify the diver's job in that, unlike calipers, they cannot be knocked out of adjustment underwater, and they do not have to be checked and reset between dives. Figure A-1 contains the drawings and data required to fabricate these gauges. Although these gauges are a quick and efficient way of sampling the wire size of chain links and some jewelry, the divers still have to carry calipers to measure ground rings and chain connecting links.

The locations for measuring chain links are shown in Figure A-1.

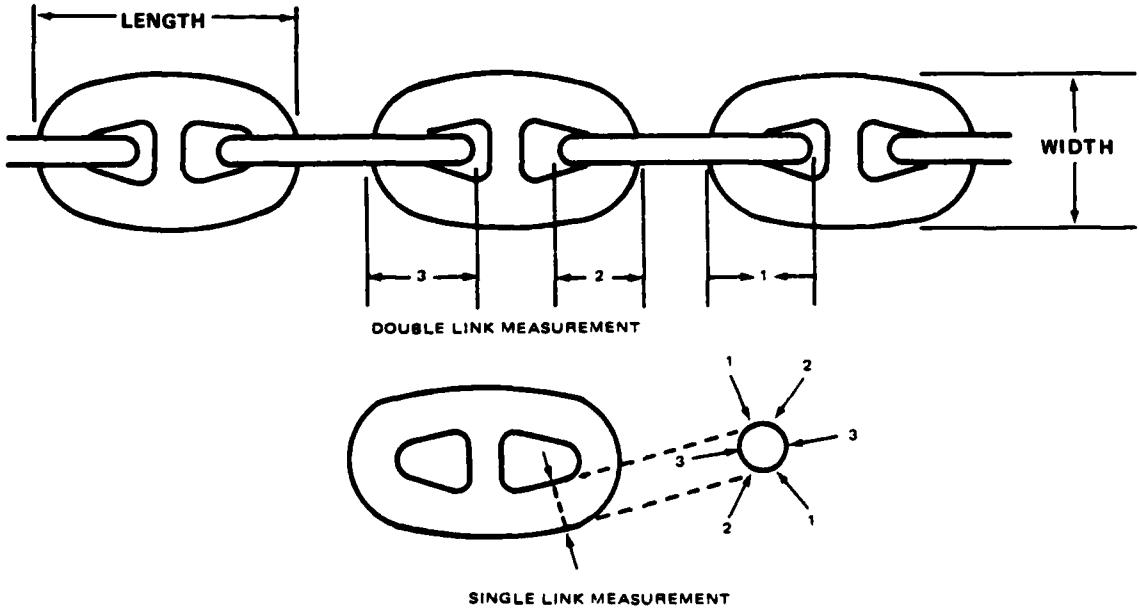


FIGURE A-1. LOCATIONS FOR TAKING CHAIN LINK MEASUREMENTS

TABLE A-1. SINGLE LINK MEASUREMENTS FOR COMPONENTS OF RISER-TYPE MOORINGS
(DOUBLE VALUES FOR DOUBLE LINK MEASUREMENTS)

Class Moor Ring	Percent Remaining	Top of Buoy			Riser Chain			Ground Ring			Ground Tackle			Anchor ^a Stockless w/ Stud Tiller		LWT
		F-Shackle	End Link	AJL ^b	AJL ^b	Ring	Spider	Chain	AJL ^b	Spider	Chain	AJL ^b	Spider	Chain		
A-A	100	5 3/8	4"	4"	3.6	4"	3.6	3.6	2.7	3.6	2.7	2 3/4"	2 3/4"	2 3/4"	25,000	-
	90	4.838	3.285	2.92	3.2	5.05	5.2	3.2	2.4	5.05	5.2	2.2	2.45	2.25		
B-B	100	6 15/16	3 15/16	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	2.4	3 1/2	3 1/2	2.0	2.0	2.0	20,000	13,000
	90	6.44	3.514	2.8	2.8	5.05	5.2	3.2	2.4	5.05	5.2	2.0	2.0	2.0		
C-C	100	4 15/16	3 15/16	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	2.4	3 1/2	3 1/2	2.0	2.0	2.0	18,000	10,000
	90	4.44	3.544	2.8	2.8	5.05	5.2	3.2	2.4	5.05	5.2	2.0	2.0	2.0		
D-D	100	4 3/16	3 3/4	3"	3"	3"	3"	3"	2.4	3"	3"	2.0	2.0	2.0	30,000	-
	90	3.269	3.375	2.7	2.7	5.4	5.4	5.4	2.4	5.4	5.4	2.7	2.7	2.7		
E-E	100	3.35	3	2.4	2.4	4.8	4.8	4.8	2.4	4.8	4.8	3"	3"	3"	30,000	-
	90	3.78	3 3/8	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2.4	2 3/4	2 3/4	2.4	2.4	2.4		
F-F	100	3.488	3.038	2.7	2.7	4.95	4.95	4.95	2.2	4.95	4.95	2.2	2.2	2.2	25,000	-
	90	3.1	2.7	2.2	2.2	4.4	4.4	4.4	2.2	4.4	4.4	2.2	2.2	2.2		
G-G	100	3 1/2	3 1/8	2 1/2	2 1/2	4.75	4.75	4.75	2.25	4.75	4.75	2.25	2.25	2.25	20,000	13,000
	90	3.15	2.813	2.5	2.5	4.275	4.275	4.275	2.25	4.275	4.275	2.25	2.25	2.25		
H-H	100	3 1/8	2 3/4	2 1/2	2 1/2	4.05	4.05	4.05	2.25	4.05	4.05	2.25	2.25	2.25	10,000	10,000
	90	2.813	2.813	2.5	2.5	3.6	3.6	3.6	2.25	3.6	3.6	2.25	2.25	2.25		
I-I	100	2.8	2.5	2.0	2.0	2"	2"	2"	1.8	2"	2"	1.8	1.8	1.8	10,000	6,000
	90	2.5	2.5	1.8	1.8	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6		
J-J	100	3 1/8	2 3/4	2 1/2	2 1/2	4.05	4.05	4.05	2.25	4.05	4.05	2.25	2.25	2.25	10,000	6,000
	90	2.813	2.813	2.5	2.5	3.6	3.6	3.6	2.25	3.6	3.6	2.25	2.25	2.25		
K-K	100	2.174	2.025	1.8	1.8	1.575	1.575	1.575	1.4	1.575	1.575	1.4	1.4	1.4	9,000	4,000
	90	2.174	2.025	1.74	1.74	1.375	1.375	1.375	1.4	1.375	1.375	1.4	1.4	1.4		
L-L	100	1 3/4	1 3/4	1 1/2	1 1/2	1.125	1.125	1.125	1.0	1.125	1.125	1.0	1.0	1.0	5,000	2,000
	90	1.515	1.515	1.4	1.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
M-M	100	1 1/16	1	.9	.9	.675	.675	.675	.6	.675	.675	.6	.675	.675	3,000	300
	90	.956	.956	.85	.85	.6	.6	.6	.6	.6	.6	.6	.6	.6		

Copy available to DTIC does not
permit fully legible reproduction

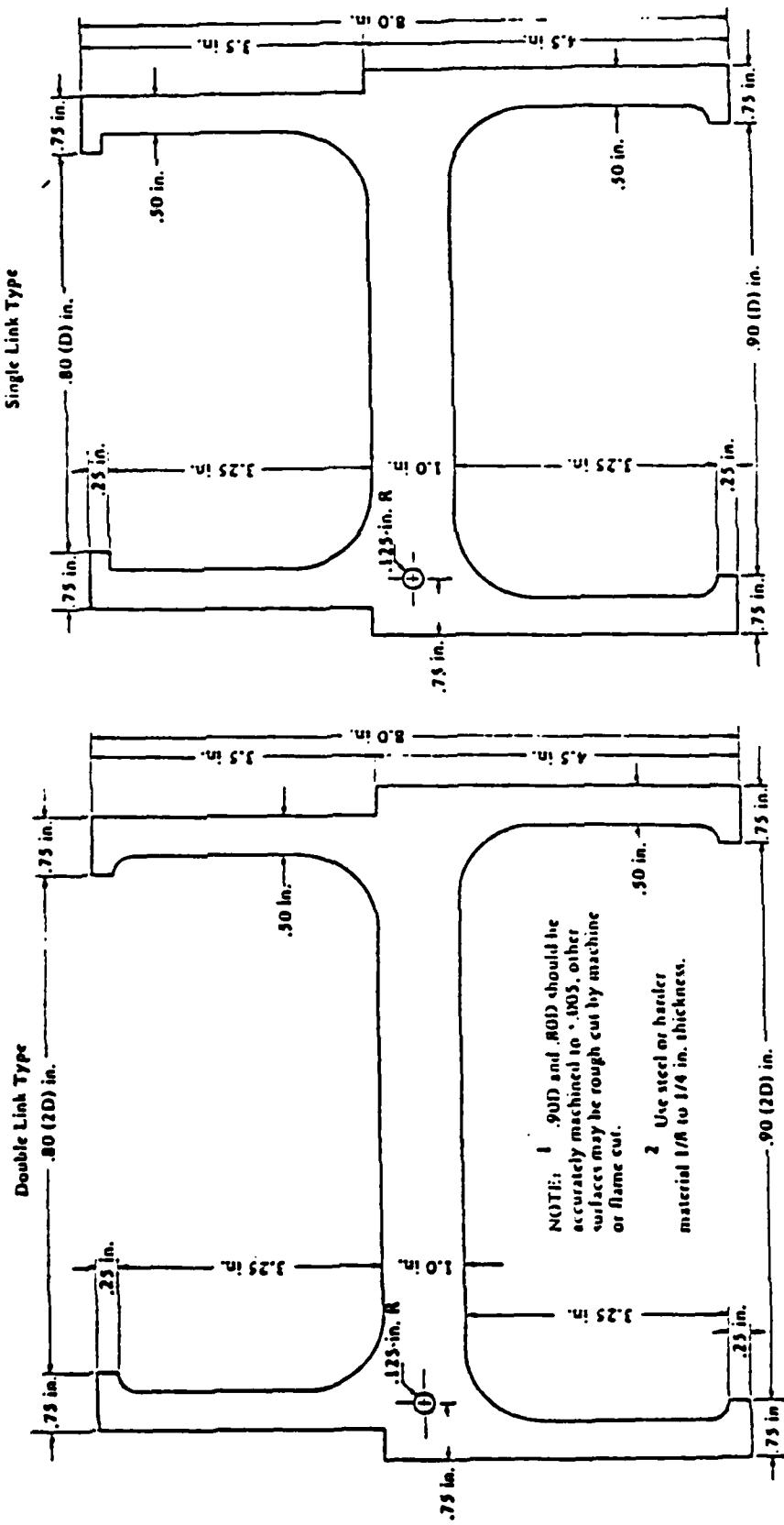
1. AJL measurement vary according to manufacturer. See Item 26
2. Assumes firm sand bottom
3. Assumes cast steel chain

TABLE A-2. SINGLE LINK MEASUREMENTS FOR COMPONENTS OF TELEPHONE-TYPE MOORINGS
(DOUBLE VALUES FOR DOUBLE LINK MEASUREMENTS)

Class Mooring	Percent pre-tension	Length of Link	Length of Buddy Link	Length-to-ground Shackles	Length-to-ground Rig	Length-to-ground Tackle Spider	Ground Tackle Rig	Ground Tackle Chain	Starless/Starbitter Anchor	LWT
A-A	100	4'	4"	4 11/16	4"	4	3	2 3/4"	2 3/4	25,000
	90	3.285	2.92	type	4.219	3.75	3.6	2.7	2.475	
B-B	100	4'	4"	4 11/16	3 1/2"	3.2	2.4	2"	2.2	13,000
	90	3.285	2.92	type	4.219	3.75	3	2 1/2"	2.25	
C-C	100	4'	4"	4 11/16	3 1/2"	3.2	2.4	2"	2.0	20,000
	90	3.285	2.92	type	4.219	3.75	4	3	2.5	
D-D	100	4'	4"	4 11/16	3 1/2"	3.2	2.4	2"	2.0	10,000
	90	3.285	2.92	type	4.219	3.75	3.6	2.7	2.025	
E-E	100	4'	4"	4 11/16	3"	3.2	2.4	1.8	1.8	18,000
	90	3.285	2.92	type	4.219	3.75	3.6	3"	3	
F-F	100	4'	4"	4 11/16	3"	3.2	2.4	3"	3	30,000
	90	3.285	2.92	type	4.219	3.75	3	3"	2.7	
G-G	100	3 3/8	3 1/2"	3 7/8	2 3/4"	3.1	2.4	2 3/4"	2.475	25,000
	90	3.038	2.7	type	3.038	3.1	3.0	type	2.2	
H-H	100	3 3/8	3 1/2"	3 1/2"	2 3/4"	3.1	2.4	2"	2.25	13,000
	90	3.038	2.7	type	3.038	3.1	3.0	type	2.0	
I-I	100	3 3/8	3 1/2"	3 1/8	2 3/4"	3.1	2.4	2"	2.025	10,000
	90	3.038	2.7	type	3.038	3.1	3.0	type	1.8	
J-J	100	3 3/8	3 1/2"	3 1/8	2 3/4"	3.1	2.4	2"	2.025	13,000
	90	3.038	2.7	type	3.038	3.1	3.0	type	1.6	
K-K	100	3 3/8	3 1/2"	2 13/16	2"	2.5	2	2"	1.8	6,000
	90	3.038	2.7	type	2.511	2.25	2	type	1.6	

1. All measurements vary according to manufacturer. see BM-26
2. Assumes firm sand bottom
3. Assumes cast steel chain

Copy available to DJIC does not permit fully legible reproduction



D"	Single Link		Double Link		Single Link		Double Link		Single Link		Double Link			
	.90D	.80D	.90(2D)	.80(2D)	.90D	.80D	.90(2D)	.80(2D)	.90D	.80D	.90(2D)	.80(2D)		
6-1/2	(1) 5.85	5.20	—	—	(6) 3.15	2.80	(1) 6.30	5.60	2	(1) 1.80	1.60	(2) 3.60	3.20	
6	(2) 5.40	4.80	—	—	(1) 2.70	2.40	(1) 5.40	4.80	1-7/16	(1) 1.69	1.50	—	—	
5-1/2	(3) 4.95	4.40	—	—	(1) 2.34	2.20	(1) 4.96	4.40	1-3/4	(1) 1.58	1.40	(2) 3.06	2.80	
4-1/2	(1) 4.05	3.60	—	—	(1) 2.12	2.00	(2) 4.50	4.00	1-1/2	(1) 1.35	1.20	(2) 2.10	2.40	
4	(5) 3.60	3.20	(16) 7.20	6.40	2.14	(1) 2.03	1.80	(2) 4.06	3.60	1-1/4	(1) 1.125	1.00	—	—

Copy available to DTIC does not
permit fully reliable reproduction

FIGURE A-2. 10 PERCENT "GO-NO-GO" GAUGES

ANNEX B

SAMPLE INSPECTION FORMS

Tables B-1, B-2, and B-3 depict three forms the EIC and divers may use to record measurements and as-built data.

TABLE B-1 **MOORING NO.:** _____ **CLASS:** _____ **LOCATION:** _____ **LAT:** _____ **LONG:** _____

TABLE B-1

WATER DEPTH: _____ ANCHOR SIZE/TYPE: _____ BUOY TYPE: _____

ANCHOR SIZE/TYPE: _____ BUOY TYPE: _____

Bottom Type: SAND MUD CLAY ROCK CORAL Visibility: 0' 10' 20' 30' 40' 50' 60' 70' 80' 90' 100' D = depth NI = not inspected, inaccessible

ROCK **Visibility** _____ **D** = **depth** **N** = **not inspected, inaccessible**

TABLE B-1

DATE:

ENGINEER-IN-CHARGE:

DIVERS:

113

TABLE B-2. CATENARY DATA

MOORING NO: _____ CLASS: _____ LOCATION: _____

DATE: _____ ENGINEER-IN-CHARGE: _____ DIVERS: _____

NOTE: Take readings at specified depths.

TABLE B-3

MOORING#	CLASS	LOCATION	DATE
BOTTOM TYPE	WATER DEPTH	MOORING CONDITION	
ENGINEER-IN-CHARGE	DIVERS		
BUOY TYPE DIMENSIONS CONDITION TOP HARDWARE BOTTOM HARDWARE		LEG C LENGTH EXPOSED LENGTH TYPE CHAIN LINK WIDTH WIRE DIAM.	
RISER LENGTH TYPE CHAIN LINK WIDTH WIRE DIAM.		LEG D LENGTH EXPOSED LENGTH TYPE CHAIN LINK WIDTH WIRE DIAM.	
GROUND RING LOC. OUTER DIAM. WIRE DIAM. CONDITION		RISER CONNECTIONS	
LEG A LENGTH EXPOSED LENGTH TYPE CHAIN LINK WIDTH WIRE DIAM.		LEG CONNECTIONS	
LEG B LENGTH EXPOSED LENGTH TYPE CHAIN LINK WIDTH WIRE DIAM.		OTHER	

ANNEX C

RESULTS OF 1979 ARDM INSPECTION

General

All single link and double link dimensions are 80% of the original link diameter (80%D) or greater.

Pitting on all underwater components is approximately 1/8 inch except ARDM leg K which exhibited pitting up to 1/4 inch. Pitting was less near the mudline for all underwater components.

The visual inspection did not reveal any holes, fissures, cracked links, missing studs or inoperative shackles. Deficiencies concerning swivels and fouling by extraneous wire rope or chain are listed under the individual moorings as applicable. Joining links and sinkers that were found were observed to be in good condition.

Auxiliary Mooring

All three legs were followed from the ground ring to 5'± below soft bottom.

The riser chain is fouled by wire rope.

The buoy is listing severely. Very little coating remains and the top cover plates are loose and warped.

Mediterranean Mooring

Chains were followed from 5'± above the water line to 5'± below the soft bottom.

Chains are twisted above the water indicating inoperative swivels.

Buoys are in good condition except the wire rope connecting the buoy to the chain of leg 2 is in need of immediate replacement.

Leg 1 is fouled by a wire rope.

Concrete sinkers were not found on leg 2.

ARDM Mooring

All chains were followed from the vessel to 5'± below the soft mud bottom.

Five of the thirteen chains are in tension. The other eight chains are slack.

All voltmeter readings were discernible to below the mudline. The readings varied between -1.020 volts and -1.400 volts.

Fouling by extraneous wire rope was found on all legs except legs B and M.

Legs could not be followed far enough to find indications of encroachment on the leg anchor position by previous dredging.

Bearings of the anchors could not be obtained because all of the anchor lines either drop vertically into the mud or enter the mud within 50 feet of the ARDM.

END

DTIC

6- 86